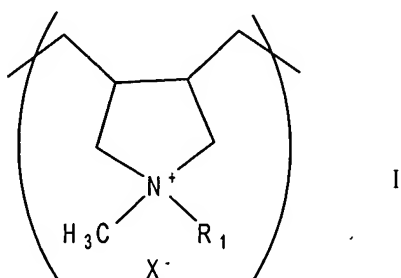


Patent claims

1. Water soluble branched block copolymers that comprise polymeric backbone chains of quaternary ammonium units of general formula I

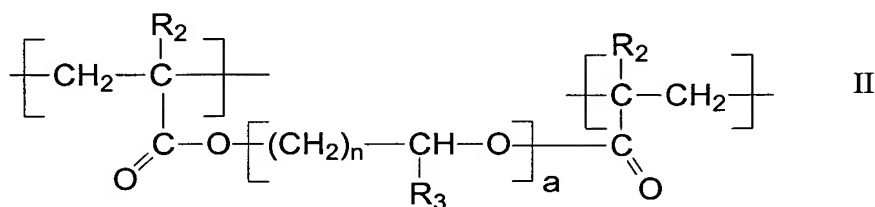


with

$R_1 = \text{H, alkyl (C}_1\text{-C}_8\text{)}$

$X^- = \text{a suitable counterion,}$

whereby the backbone chains are mutually linked together by way of the feature that poly(alkylene glycol) blocks, which comprise units of general formula II



with

$R_2 = \text{H, methyl,}$

$R_3 = \text{H, methyl, ethyl,}$

$X^- = \text{a suitable counterion}$

$n = 1 \text{ through } 3, \text{ and}$

$a = 6 \text{ through } 100,$

replace individual units of general formula I, and the proportion by mass of the units of general formula II is between 0.01 and 20 % by weight based on the total block copolymer.

2. Block copolymer in accordance with claim 1, characterized by the feature that the molar mass of the block copolymer is greater than, or equal to, 250,000

g/mol, and especially preferably greater than, or equal to, 1,000,000 g/mol.

3. Block copolymer in accordance with at least one of the claims 1 or 2, characterized by the feature that the intrinsic viscosity of the block copolymer is between 25 and 600 ml/g when measured in 1 N sodium chloride solution at 30 °C.

4. Block copolymer in accordance with claim 3, characterized by the feature that the intrinsic viscosity of the block copolymer is between 400 and 600 ml/g.

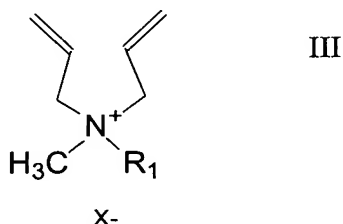
5. Block copolymer in accordance with at least one of the claims 1 through 4, characterized by the feature that the Huggins constant is in the range between 0.3 and 0.5.

6. Block copolymer in accordance with at least one of the claims 1 through 5, characterized by the feature that the polymeric backbone chain is derived, in the form of a unit of general formula I, from cyclic quaternary ammonium chlorides.

7. Block copolymer in accordance with at least one of the claims 1 through 6, characterized by the feature that the poly(alkylene glycol) blocks are derived from compounds from the group of bis-acrylate esters or bis-methacrylate esters of poly(ethylene glycols), poly(propylene glycols), poly(butylene glycols), and/or polytetrahydrofurans.

8. Block copolymer in accordance with at least one of the claims 1 through 7, characterized by the feature that the counterions  $X^-$  are selected independently of one another from the group comprising chloride and methosulfate.

9. Process for the preparation of water soluble branched block copolymers via the [free] radical polymerization of a quaternary diallylammonium compound of general formula III,

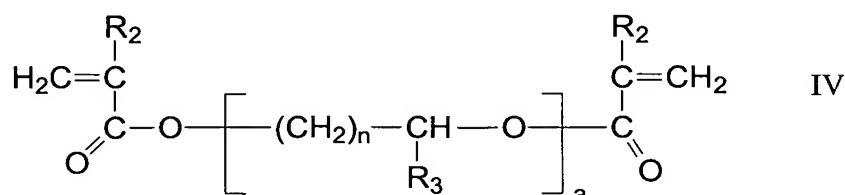


with

$R_1 = \text{H, alkyl (C}_1\text{-C}_8\text{)}$

$X^- = \text{a suitable counterion,}$

- 5 and bis-acrylate esters or bis-methacrylate esters of poly(alkylene glycols) of general formula IV,



- 10 with

$R_2 = \text{H, methyl,}$

$R_3 = \text{H, methyl, ethyl,}$

$X^- = \text{a suitable counterion,}$

$n = 1 \text{ through } 3, \text{ and}$

- 15  $a = 6 \text{ through } 100,$

whereby the proportion by mass of the compound of general formula IV amounts to between 0.01 and 20 % by weight based on the two starting compounds.

- 20 10. Process in accordance with claim 9, characterized by the feature that diallyldimethylammonium chloride is used as the diallylammonium compound.

11. Process in accordance with at least one of the claims 9 or 10, characterized by the feature that compounds from the group of bis-acrylate esters or bis-methacrylate esters of poly(ethylene glycols), poly(propylene glycols), poly(butylene glycols), and/or polytetrahydrofurans are used as the poly(alkylene glycol).
- 25

12. Process in accordance with at least one of the claims 9 through 11, characterized by the feature that, as the initiator, use is made of a water soluble azo compound, or a redox system comprising peroxodisulfates and an amine.
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13. Process in accordance with claim 12, characterized by the feature that, as the initiator, use is made of a redox system comprising peroxodisulfates and an

alkoxylated amine surfactant.

14. Process in accordance with at least one of the claims 9 through 13,  
characterized by the feature that the poly(alkylene glycol) is added during  
5 polymerization of the quaternary diallylammonium compound within the 0 to 80 %  
range of extents of reaction either in the form of one shot, or in portions, or continuously.

15. Process in accordance with at least one of the claims 9 through 14,  
characterized by the feature that the process takes place in aqueous solution.

10 16. Process in accordance with at least one of the claims 9 through 15,  
characterized by the feature that the process takes place using the inverse emulsion  
procedure.

15 17. Use of the block copolymers in accordance with at least one of the  
claims 1 through 8 as coagulating agents and flocculating agents for the separation of  
suspended solids.

20 18. Use in accordance with claim 17 for the manufacture of paper, the  
treatment of waste water, and the removal of water from sludge.